What is claimed is:

1. A stable alcohol-in-fluorocarbon microemulsion composition comprising:
an alcohol dispersed phase,
a fluorocarbon continuous phase,
a molecule of interest dissolved or dispersed in alcohol,
a film-forming substance dissolved or dispersed in the alcohol,
a surfactant or co-surfactant or a mixture thereof, and
a cell-targeting ligand.

2. The microemulsion according to claim 1, wherein the molecule of interest is a drug molecule, a food, a magnet, or a sensor molecule.

3. The microemulsion according to claim 1, wherein said fluorocarbon is perflubron.

4. The microemulsion according to claim 1, wherein said film-forming substance is ethyl cellulose.

5. The microemulsion according to claim 1, wherein said surfactant is a fluorosurfactant.

6. The microemulsion according to claim 1, wherein said alcohol is ethanol.

7. The microemulsion according to claim 2, wherein said drug molecule is plasmid DNA, oligonucleotide, peptide, protein, antibody, small drug molecule, or a rare-earth molecule.

8. The microemulsion according to claim 2, where said sensor molecule responds in a controlled and predictable manner to changes in temperature, pH, pressure, or the presence of another substance.

9. The microemulsion according to claim 1, wherein said cell-targeting ligand is asialofetuin, mannan, mannose, folate, a saccharide, or an antibody.

10. The microemulsion according to claim 1, wherein said alcohol is removed from the microemulsion by evaporation or by dilution with a suitable solvent to cause the film-forming substance to precipitate into solid nanoparticles having a diameter less than about 300 nanometers.

11. A method for purifying or characterizing a solid nanoparticle comprising removing alcohol from the microemulsion according to claim 1 by evaporating or diluting with a suitable solvent thereby curing said nanoparticle in a continuous phase, and subjecting the cured nanoparticle to gel permeation or ultracentrifugation, and obtaining a solid nanoparticle.

12. A stable liquid hydrocarbon-in-fluorocarbon microemulsion prepared at a temperature of between about 35-100°C and having a composition comprising:

a liquid hydrocarbon dispersed phase,

a fluorocarbon continuous phase,

a molecule of interest dissolved or dispersed in the liquid hydrocarbon,

a surfactant or co-surfactant or a mixture thereof, and

a cell-targeting ligand.

13. The microemulsion composition according to claim 12, wherein said fluorocarbon is perflubron.

14. The microemulsion according to claim 12, wherein said liquid hydrocarbon is a solid at about 25°C, has a melting point of between about 35-100°C, is water-insoluble, and is amphipathic having both hydrophobic and hydrophilic moieties.

15. The microemulsion according to claim 12, wherein said surfactant is a fluorosurfactant.

16. The microemulsion according to claim 12, wherein said molecule of interest is a drug molecule.

17. The microemulsion according to claim 12, where said molecule of interest is a sensor molecule that responds in a controlled and predictable manner to changes in temperature, pH, pressure, or the presence of another substance.

18. The microemulsion according to claim 12, wherein said cell-targeting ligand is asialofetuin, mannan, mannose, folate, a saccharide, or an antibody.

19. The microemulsion according to claim 12, wherein the microemulsion is cooled to cause the hydrocarbon to solidify into solid nanoparticles having a diameter less than about 300 nanometers.

20. A method for purifying or characterizing a solid nanoparticle, comprising cooling the microemulsion according to claim 12, wherein said hydrocarbon is solidified into solid nanoparticles containing said molecule of interest thereby curing said nanoparticle in a continuous phase, and subjecting the cured nanoparticle to gel permeation or ultracentrifugation, and obtaining a solid nanoparticle.

21. A nanoparticle comprising:

at least one liquid nanoparticle matrix material,

at least one surfactant or co-surfactant or a mixture thereof, and

at least one molecule of interest, wherein said nanoparticle is made from an oil-in-water microemulsion precursor.

22. The nanoparticle according to claim 21, wherein in said oil-in-water microemulsion precursor, an oil phase comprised of at least one nanoparticle matrix material and at least one molecule of interest is dispersed in an aqueous continuous phase to form a surfactant stabilized microemulsion between about 35°C and about 100°C, wherein the micromulsion is cooled to room temperature while stirring to form solid stable nanoparticles containing at least one molecule of interest either entrapped in or adsorbed to the nanoparticles having a diameter of less than about 300 nanometers.

23. The nanoparticle according to claim 22, wherein the nanoparticle matrix material comprises one or more of the following materials: emulsifying wax, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene alkyl ethers, polyoxyethylene stearates, phospholipids, fatty acids or fatty alcohols or their derivatives, or combinations thereof.

24. The nanoparticle according to claim 21, wherein the liquid nanoparticle matrix material is present in the microemulsion at a concentration from about 0.1 to about 30 mg/mL.

25. The nanoparticle according to claim 22, wherein said oil phase is present as liquid droplets having a diameter of less than about 100 nanometers.

26. The nanoparticle according to claim 22, wherein said continuous phase is water or an aqueous buffer present at a concentration of greater than about 95% w/w.

27. The nanoparticle according to claim 21, wherein said surfactant or co-surfactant is polyoxyethylene alkyl ethers, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene stearates, hexadecyltrimethylammonium bromide, fatty alcohol and their derivatives, or combinations, thereof.

28. The nanoparticle according to claim 21, wherein said surfactant is present at a total concentration of about 1-5000 mM.

29. The nanoparticle according to claim 21, wherein said molecule of interest is present at a total concentration in the range of about 20 μg/mL to about 5 mg/mL.

30. The nanoparticle according to claim 21, wherein said molecule of interest is a drug molecule, a food, a magnet, or a sensor molecule.

31. The nanoparticle according to claim 21, wherein said molecule of interest is plasmid DNA.

32. The nanoparticle according to claim 21, wherein said molecule of interest is Gadolinium, its derivatives or complexes thereof.

33. The nanoparticle according to claim 21, wherein said nanoparticle is coated with a cell-specific ligand such as an antibody, carbohydrate, peptide, protein, or derivatives or combinations thereof.